Airborne Observations of Soil Moisture and Vegetation During SGP'99 Using the PALS Sensor

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Abstract

A new airborne sensor has been developed recently to investigate the benefits of multichannel active and passive microwave remote sensing of soil moisture. The sensor is the Passive/Active L/S-band (PALS) sensor designed to be flown on a C-130 aircraft. PALS was flown for the first time during the 1999 Southern Great Plains experiment (SGP'99) in Oklahoma, and acquired data over several flight lines in conjunction with ground sampling of soil moisture and other surface characteristics. The PALS contribution to SGP'99 results is a set of calibrated brightness temperature and radar backscatter data that can be used to study the dual-polarized passive and active sensitivity to soil moisture and vegetation at L and S bands. PALS data will be used with other L and C-band airborne sensors flown at different altitudes during SGP'99 to study calibration, spatial scaling, and frequency-dependent effects at 1 to 7 GHz. PALS data from the six days of flights over field sites in the Little Washita basin confirm the high sensitivity to soil moisture at L-band, and the increased sensitivity to vegetation at S-band. The observed correlation of the L-band horizontally polarized brightness temperatures with in-situ sampled soil moisture is very high (correlation coefficient >0.92) since the majority of fields sampled had bare or pasture vegetation cover with biomass less than 0.5 kg m^{-2}. Adjacent east-west flight lines were flown on each day of the mission, enabling images of the Little Washita area to be produced for each radiometer and radar sensor channel. These images show sensor channel-dependent spatial patterns of wetting and drying that are linked to the soil, vegetation, and topography of the basin. Solar effects due to surface reflection or antenna sidelobe contamination were observed as small brightness temperature offsets between the west-east and east-west flight directions. Work is in progress to investigate the vegetation and surface roughness joint information content of the passive and active data in improving the estimation of soil moisture.